

CONTROLLING & CALIBRATING VEHICLE-RELATED ISSUES USING RFID TECHNOLOGY

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ABSTRACT

This study explains how to control vehicle's emission level and also how to keep traffic under control by using Radio Frequency Identification (RFID) technology. The RFID can also provide complete details about the vehicle. Further, it helps to control traffic flow, keep emission under control, remove all outdated vehicles, generate parking bills and avoid health-related issues. There are many advantages of implementing this RFID system. The semi-passive and the RFID reader monitor the hardware is placed in all traffic signals, tollgates, and parking slots. It reads the entire tag of vehicles crossing the system filters the problematic vehicles and instantly alerts the concerned department to take appropriate action against the drivers. This system is not enforced in India is being successfully practiced in most of the western countries. There is urgent to implement an RFID system in India for the advancement of a transportation system that controls pollution and traffic congestion.

KEYWORDS: RFID, Automobile, Transportation System, Vehicle Issues & Emission

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INTRODUCTION

The automobile is one of the major sources of air pollution. It emits carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides (NO_x), sulfur oxides (SO_x), hydrocarbons (HC), particulate matter (PM), and volatile organic compounds (VOCs) at different levels [2]. It is found that vehicle emission contains 70% of carbons, 45% of nitrogen oxide and 34% of hydrocarbon in the tailpipe. It affects the natural environment to a great extent. It also has a serious impact on human health, causing cancer, stroke, diarrhea, chest pain, bronchial hyperactivity, skin disease, heart disease, eye problem, respiratory problem, cardiovascular disease, failure of the central nervous system, etc. [15]. Around 900 million people in developing countries like India will be exposed to an unhealthy level of pollutants due to motor-vehicle caused emissions [3]. According to Dr. Maria Neira, "Few risks have a greater impact on global health today than air pollution, the evidence signals that there is a need for concerted action to clean-up the air we all breathe" [11].

In India, there are millions of vehicles produced every year and these spoil the entire ecosystem. Further, it has been projected that the production of vehicles may increase up to 40% by the end of 2030, among that it is forecasted that upto 50 million cars will be added on the road by 2030. According to a report of the Organization Internationale des Constructeurs d'Automobiles (OICA) 2017, globally, the automobile is

responsible for 24% of carbon emission which is the major cause for the formation of greenhouse gas and global warming[8]. On an average, per kilometer, a vehicle can emit 140-250grams of carbon. In India, vehicle emissions contribute up to 70% of air pollution. According to a recent study in which 170 countries were surveyed about Environmental Performance Index (EPI), the results show that India has the worst air pollution, beating China, Bangladesh, Nepal, and Pakistan. "The city is under threat and the worst part is that since we don't see the enemy, we tend to take it lightly. But, these poisonous particles are there in the air we breathe. If we don't fix it, the air will kill us. If it continues to be like this, by 2050 India will be the worst victim of the air pollution[5]".

The lifespan of a vehicle on an average is 10 years. But, in India people are using their vehicles for more than 10 years and this is one of the major reasons for air pollution. These vehicles emit up to 75% higher than the normal vehicles. Further, they also cause traffic congestion as these vehicles are more in number [9].

In the modern world, we are facing innumerable pollution-related issues and these problems will have a solution by the usage of the Radio Frequency Identification Technology[1]. It checks the entire data of a vehicle such as a vehicle smoke test, license year, insurance, owner detail, etc. The trackers will be placed in toll gates, traffic signals, parking slots and important junctions to read the vehicle status. Most of the western countries like Germany, France, Switzerland and the UK are practicing the RFID technology, in order to monitor the vehicle's emission level, the smooth function of traffic flow, the removal of outdated vehicles, the status of the vehicle emission certificate, the number of kilometers traveled, the vehicle type, the license and insurance status. It will provide complete details about the vehicle through proper maintenance of the vehicle database[4, 14].

FUNCTIONING OF RFID

The semi-passive RFID tag is placed inside the vehicle. The complete data of a vehicle are stored in the traffic information database collected by the Department of Transportation[DOT]. The RFID readers will be placed with an embedded controller in traffic signals, tollgates, parking areas and important junctions. So, whenever a vehicle is crossing that signal area, the RFID system will automatically read the entire database about a particular vehicle. The tag helps to read the vehicles at any speed in constraint to the traffic density [4]. Based on the current vehicle data like outdated vehicles, stolen vehicle, unpaid insurance, expired license, etc., it will give alerts by beep sound and voice message to the concerned traffic police department.

RELEVANCE OF RFID

The RFID technology used in most of the western countries helps them to solve environmental as well as social problems. In the recent years, this technology is available at a very cheap price which can improve the business performance and also save time. For example, in January 2005, Wal-Mart installed the RFID technology for the smooth function of its business[6]. As it helps them to track the shipping inventory within a minute more than 100 suppliers got benefitted from the RFID system.

The paper briefly explains the RFID technology and the system,

- What is RFID, and how does it work?
- What are the applications of RFID?
- What are the major challenges and problems in RFID technology and implementation?

- How do organizations implement RFID?

The answer to the above questions will provide an organizational framework for RFID operation in both technical and business perspectives.

TECHNICAL OVERVIEW OF RFID

The basic premise behind the RFID system is marked with tags. These tags contain transponders messages readable by specialized RFID readers. Most RFID tags can store with a Unique Identification Number (UIN), for example, a customer number or product Stock-Keeping Unit (SKU) code. Further, they read and retrieve information through the customer's ID number from the database. RFID tags can also contain writable memory, which can update the information from a Central Database; transfer those updates to RFID trackers which can read from any location. This information can be automatically encrypted at any speed of the tag movement. By accessing and decoding that available information, complete information about the vehicle can be retrieved.

The RFID Tags

The RFID tags fall into two general categories, one is active and another is passive. These depend on the source of electrical power. The active RFID tags contain own power source which is usually on-board battery. The passive tags receive power from the signal of the external reader. RFID readers are used in both active and passive varieties, depending on the type of tag they read.



Figure 1: RFID Tag

Design

Here there are two sections of hardware, one is on the vehicle's semi-passive RFID tag section and another are a reader model embedded in traffic signals, tollgates, parking areas and important junctions.

Vehicle Section

In this vehicle section, semi-passive RFID tag is used. The semi-passive GAO 137005-9-P tag is used in the following application. It contains 6M and 57 bytes of memory and 915 MHz range. It shows updated information such as the status of the smoke test, vehicle insurance, RC book, owner details, etc.,[7].

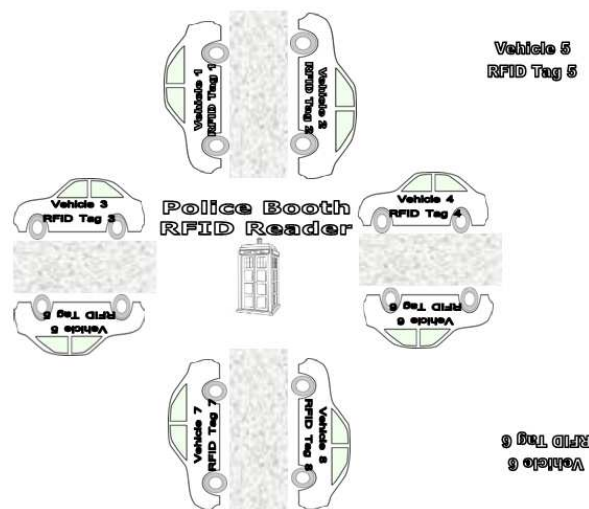
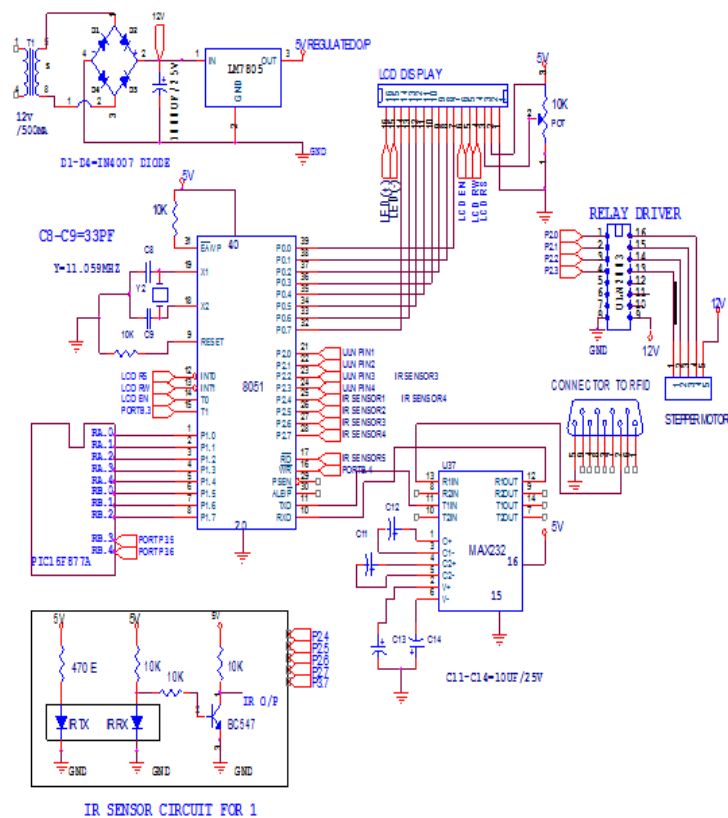


Figure 2: Block Diagram

Embedded Module

Embedded Module is considered the heart of the project module. In the above block diagram, there is an RFID reader with a microcontroller, digital display, audio alert and vehicle speed measuring meter focused towards the vehicles. The RFID reader is connected to a serial port of the microcontroller. It reads the vehicles RFID tag data and the same appears on the display unit. The audio system is used to announce the issues about the vehicle. The vehicle speed indicator checks speed limit and gives beep sound to alert the concerned policemen through voice mail and message.



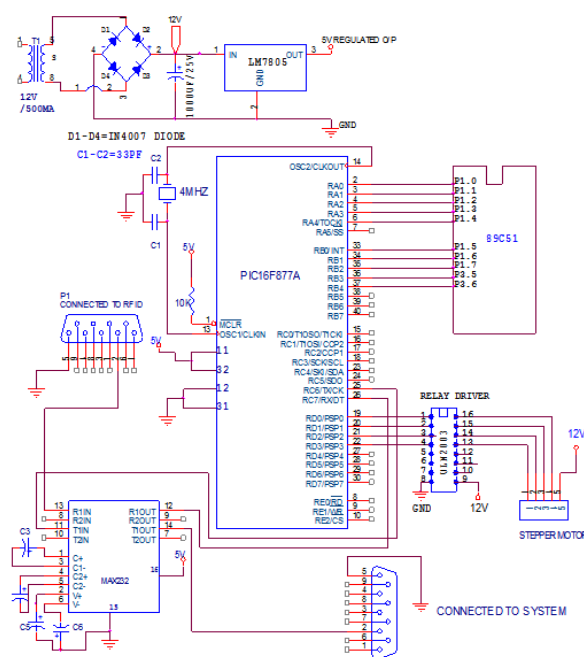


Figure 3: Schematic of Embedded Module

Implementation

The hardware is mainly concentrated on the microcontroller embedded module development. Here it is an Atmel89c51 microcontroller and PIC16F877A microcontroller is used as a controlling device. In this embedded on-board RFID reader, a display unit, stepper motors and audio unit (speaker & amplifier) are used to interface with the microcontroller.

Whenever a vehicle crosses a traffic signal, the vehicle tag is transmitted to an RFID system. Suppose the vehicle is not insured or not renewed or has improper smoke test status, or is stolen, etc., the same will be sent to the embedded module through the RFID reader. The optical reflector sensor meter used by the RFID reader simultaneously checks the speed and other traffic rule violation issues. Then, it immediately shows in the display system and has an audio message sent to the policeman. Instantly, the police can file a charge sheet on the particular vehicle and take necessary action against the driver.

MANAGING TRAFFIC CONGESTION

It can also manage traffic congestion using this concept. Normally, in an ordinary traffic control system, they follow the traditional system of time division management concept [12]. It does not consider the traffic density during peak hours in a particular direction. Sometimes traffic may be high in particular junctions but the signal gives uniform time for all directions due to default traffic system which may cause high traffic congestion.

By using this RFID technology, we can give an appropriate solution to this issue of traffic congestion. Traffic is managed intelligently in this mode. The vehicle density in a particular direction is detected by the RFID reader and based on that the signal will be activated in a particular direction [13]. The area with more traffic is given first priority. The signal priority is selected based on the flow of traffic density. By using this concept, the RFID technology manages traffic congestions and problems.

PARKING SLOT MANAGEMENT

The parking slot management is also done through automatic identification. Whenever the vehicles enter the parking area, the readers automatically read the vehicle information based on the vehicle size and parking slot will be allocated. Based on the departure and the arrival time, the system will also generate the precise bill. This concept is almost similar to toll gate too.

CONCLUSIONS

In this study, the RFID technology gives an appropriate solution to many vehicle-related issues such as pollution, traffic congestion, parking bill, updation, insurance, license, and others. In India, we are using a very old transport management system, hence this study proposes a modern optimized solution using the RFID technology. It keeps traffic under control, brings down pollution-level and avoids health issues. Developed countries like USA, England, Germany, and Japan have installed and linked the RFID to GPS/GSM technologies and use it widely in traffic management[4]. But in India, we don't enforce any automated system in transport management due to economic barriers. Keeping this in mind, this study has proposed the RFID system at low cost.

SCOPE OF FUTURE STUDY

The scope of future work is to design accident control/prevention by using optical sensors and RFID sensors. This plan is to control acceleration and brake systems based on data received from the sensors.

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